

U. S. NUCLEAR REGULATORY COMMISSION

REGION I

Report No. 50-352/82-12  
50-353/82-09

Docket No. 50-352  
50-353

License No. CPPR-106 Priority -- Category A  
CPPR-107

Licensee: Philadelphia Electric Company  
2301 Market Street  
Philadelphia, Pennsylvania 19101

Facility Name: Limerick Generating Station Units 1 and 2

Inspection At: Limerick, Pennsylvania

Inspection Conducted: September 8-10, 1982

Inspectors: A. A. Varela Sept. 20, 1982  
A. A. Varela, Reactor Engineering date  
Inspector

Approved By: J. P. Durr 9/26/82  
J. P. Durr, Chief, Materials and date  
Processes Section

Inspection Summary:

(Units 1 and 2) Inspection on September 8-10, 1982 (Report No. 50-352/82-12 and 50-353/82-09)

Areas Inspected: Special unannounced inspection by a regional based inspector of PECO response to NRC/IE Circular No. 81-08, Foundation Materials and verification that foundation and backfill materials supporting and proximate to safety-related structures are placed in accordance with design bases requirements. The inspection involved 24 inspector hours onsite.

Results: No violations were identified.

## DETAILS

### 1. Persons Contacted

- \*D. J. Clohecy, Quality Assurance Engineer (QAE)
- \*J. M. Corcoran, Field QA Branch Head
- \*A. C. McLean, Construction Engineer

#### Bechtel Power Corporation

- \*S. Bowie, QC - Lead Civil
- \*B. A. Dragon, QAE
- \*G. E. Fissel, Assistant Project Field Engineer
- \*E. R. Klossin, Project QAE
- \*N. K. Linn, Field Engineer
- \*D. C. Thompson, Assistant Project Field QCE
- J. L. Martin, Lead Site QAE
- T. Lieb, QCE

\*Attendees at exit meeting September 10, 1982.

### 2. Response to IE Circular No. 81-08: Foundation Materials

The IE Circular No. 81-08 on foundation materials requires no specific response from the licensee where no soil compaction construction deficiencies were identified and no corrective actions were required. The recommended action for construction permit holders contained in the circular is intended for those facilities with ongoing soils work activities. PECO obtained from BC's project engineers in San Francisco their response to the IE Circular on foundation materials for the Limerick site. BC states that all seismic category I Q-Listed structures are founded on rock or backfill concrete, hence no problems exist related to settlement on soil backfill. The licensee has documented their acceptance and approval of the BC response.

### 3. Review of FSAR, Specifications and Drawings Relative to Foundations and Backfill Requirements of Seismic Category I Structures

Revision 5 of the FSAR, Section 2.5.4.5, states that all seismic Category I rock foundations at the main power block are carried to, or well below unweathered bedrock. These include the reactor enclosures and control room structure. Rock foundations for the turbine and radwaste enclosures are prepared according to the same general procedures and criteria used in preparing the seismic Category I rock foundations. Also, the diesel-generator enclosures, the spray pond pump structure, and the spray network pipe supports are founded on bedrock. A review was performed of these structures for foundation requirements identified in specifications and drawings. The inspector verified that the above structures are required to be on bedrock. The rock exposed at foundation elevation must be examined by an experienced geologist and approved to support a foundation

load of 30 KSF. Provisions for overexcavation of soft rock and foundation excavation of some fracture zones and minor clay seams is identified. Where such excavation is required under the direction and guidance of the geologist, the replaced backfill material is required to be Class A concrete of 2,000 psi, 28 day compressive strength.

Some Category I plant facilities are not founded on bedrock. The exceptions are; part of the spray pond, underground piping, diesel oil tanks, valve pits, and electrical ducts, which are founded on natural soil. Natural soils at the site are residual soils consisting of materials derived from the in-situ weathering of siltstone, sandstone and shale. The requirements in general for these soils consist of the following:

- At least 95% of maximum dry density as determined by ASTM D698, Method D.
- In-place density tests - ASTM D1556.

A review was performed of specifications and drawings to determine design and construction criteria for backfill materials proximate to safety-related structures. In general it was observed that Class A concrete backfill is specified outside the exterior foundation walls and under slabs. Such backfill concrete is carried up to the rock profile. Backfill above this level for most Category I structures is fillcrete of 80 psi minimum compressive cube or cylinder strength. Some structures by approved option may use Type I fills consisting of broken rocks and fines obtained from the site excavations instead of a fillcrete. Type I fills are graded and limited to no longer than 8 inches in diameter. The compaction requirements of Type I fills are the following:

- 90% maximum dry density.
- Tested per AASHTO T-180-70 Method D
- In place tests per AASHTO T-191-61.

Based on these established design requirements and a review of representative samples of QC records it appears that Category I structures are precluded from excessive settlement.

#### 4. Prior NRC Inspection Reports Relating to Foundations and Backfill Materials

These NRC inspection reports provide verification of quality control activities observed and/or records reviewed relating to foundations and backfill materials.

<u>Report Number</u>	<u>Activity</u>
352, 353/71-03	Power Block (PB) rock excavation.
352, 353/73-04	Power Block (PB) rock excavation: cleanup, concrete fill and mut mat.
353/75-03	PB excavation, geologist report on acceptability of foundation.
353/75-05 and -06	Rock blasting controls.
353/76-01	Rock Blasting
352/76-04	PSAR deviation change relating to horizontal soil structure interaction.
352-76-09	UNR on requirements for soil backfill compaction and site preparation/fill placement procedures.
352/80-21 353/80-19	Spray Pond design requirements - unresolved item.
352/81-11 353/81-09	Licensee action/Spray Pond design requirements.
352/81-13 353/81-11	Observation Spray Pond excavation.
352/81-14 353/81-12	NRR personnel visit site, observe spray pond geology.
352/81-16 353/81-14	Spray pond excavation/geologist approval of rock foundation excavation.
352/82-08 353/82-06	Spray pond activities.
352/82-09 353/82-07	Spray pond activities

5. Quality Assurance Audits of Foundations and Backfill Activities

QA audits were reviewed to establish confidence that the foundation and backfill material construction activities were performed in accordance with design requirements. These BC annual audits for 1979, 1980, and 1981 cover the following specific activities:

- Earthwork in-progress controls and related testing for pipe trench bedding and backfill.
- Control and related testing of fillcrete for pipe conduits, diesel storage tank structure and spray pond.
- Underground process and yard pipe bedding and backfill.

No significant items of deficiency were identified.

A PECO audit dated April 1979, was observed to cover the diesel generator building foundations. The report specifically addresses the following:

- Geologist approval on excavated rock for 30 KSF bearing capacity.
- Overexcavated rock as required by geologist backfilled with 2,000 psi concrete.
- Controls required for placement of mud mat.

No deficiencies were identified.

Based on the above sample of QA audits, the design requirements and construction activities relating to foundations and backfill materials appear adequate to preclude settlement of plant structures.

#### 6. Review of Power Block Settlement Check

Field surveys on eighteen bench marks located on and surrounding areas of the power block structures and turbine enclosures at the 217'-0" elevation were reviewed. The survey settlement check dated July 1979, was run by precise optical leveling to obtain the variance of each bench mark from the initial recorded elevation and the difference from the mean. The individual brass bench marks had been established early in construction. From discussion with BC field engineer who had conducted the settlement check, it was learned that the bench marks were established for construction survey purpose. The bench marks were estimated to have existed 3 to 4 years and had been preserved to the extent needed during the construction of each area. The results of the 1979 settlement check show only minor variances from the original record - the mean variance being (-) 0.002" and none was more than 0.006".

Based on the above settlement check, there appears to exist no need for a settlement monitoring program.

#### 7. Exit Meeting

The inspector met with licensee's representatives (denoted in Paragraph 1) at the conclusion of the inspection on September 10, 1982, at the construction site. The inspector summarized the findings of the inspection. The licensee acknowledged the inspector's comments.